

7.3 Near channel power

7.3.1 Definition

The near channel power is that part of the total output power of a transmitter, under defined conditions of modulation, which falls within a specified passband centred on the nominal frequency of either of the adjacent channels or either of the channels centred 10 kHz from the centre of the nominal channel.

This power is the sum of the mean power produced by the modulation, hum and noise of the transmitter.

7.3.2 Methods of measurement

The near channel power may be measured with a spectrum analyser which conforms with the requirements given in Annex B.

The transmitter shall be modulated with normal test signal (B1) (sub-clause 6.1.1).

The output of the transmitter shall be connected to the input of the spectrum analyser by a 50Ω power attenuator, to ensure that the impedance presented to the transmitter is 50Ω and the level at the spectrum analyser input is appropriate.

The resolution bandwidth of the spectrum analyser shall be 100 Hz.

The integrated power present in the nominal channel shall be recorded (the wanted channel power).

For the purpose of the remainder of this test the integration bandwidth shall be 5 kHz, centred 5 kHz above the centre of the nominal channel. The integrated power present in this integration bandwidth shall be recorded (the near channel power).

The near channel power ratio is the difference (in dB) between the measured integrated wanted channel power under normal test conditions and the integrated near channel power under normal and extreme test conditions.

The measurement shall be repeated with the integration bandwidth centred at 5 kHz below the centre of the nominal channel, 10 kHz above the centre of the nominal channel, and 10 kHz below the centre of the nominal channel.

The measurement shall be made under normal test conditions (sub-clause 5.3) and repeated under extreme test conditions (sub-clause 5.4.1 and 5.4.2 applied simultaneously).

7.4 Spurious emissions

7.4.1 Definition

Spurious emissions are emissions at frequencies other than those of the carrier and sidebands associated with normal modulation.

The level of spurious emissions shall be measured as:

a) their power level in a specified load (conducted spurious emission)

and

b) their effective radiated power when radiated by the cabinet and structure of the equipment (cabinet radiation)

or

c) their effective radiated power when radiated by the cabinet and by the integral antenna, in the case of a handportable equipment fitted with such an antenna and no external r.f. connector.

7.4.2 Method of measuring the power level in a specified load (sub-clause 7.4.1 (a))

This method applies only to equipment with an external 50Ω antenna connector.

Spurious emissions shall be measured as the power level of any discrete signal delivered into a 50Ω load. This may be done by connecting the transmitter output through an attenuator to either a spectrum analyser¹ or selective voltmeter or by monitoring the relative levels of the spurious signals delivered to an artificial antenna (sub-clause 6.2).

If possible the transmitter shall be unmodulated and the measurements made over the frequency range 9 kHz to 4 GHz for equipment operating on frequencies not exceeding 470 MHz or over the frequency range 9 kHz to 12.75 GHz for equipment operating on frequencies above 470 MHz, excluding the five contiguous channels centred on the channel on which the transmitter is intended to operate.

The measurement² shall be repeated with the transmitter modulated by the normal test signal M2 (see sub-clause 6.1.3). If possible, the modulation should be continuous for the duration of the measurement.

The measurement shall be repeated with the transmitter in the "stand-by" position.

¹See also Annex B

²The bandwidth used in this measurement for each spurious emission shall be sufficiently wide to accept all significant components of the spurious emission concerned and sufficiently narrow to reject emissions in the five contiguous channels centred on the channel on which the transmitter is intended to operate. The conditions used in the relevant measurements shall be reported in the test report.

7.4.3 Method of measuring the effective radiated power (sub-clause 7.4.1 (b))

This method applies only to equipment with an external antenna connected.

On a test site, selected from Annex A, the equipment shall be placed at the specified height on a non-conducting support and in the position closest to normal use as declared by the manufacturer.

The transmitter antenna connector shall be connected to an artificial antenna (sub-clause 6.2).

The output of the test antenna shall be connected to a measuring receiver.

The test antenna shall be orientated for vertical polarisation and the length of the test antenna shall be chosen to correspond to the instantaneous frequency of the measuring receiver.

The transmitter shall be switched on without modulation, and the measuring receiver shall be tuned over the frequency range 30 MHz to 4 GHz, except for the five contiguous channels centred on the channel on which the transmitter is intended to operate. At each frequency at which a spurious component is detected, the test antenna shall be raised and lowered through the specified range of heights until a maximum signal level is detected on the measuring receiver.

When a test site according to sub-clause A.3 is used there is no need to vary the height of the antenna.

The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.

The maximum signal level detected by the measuring receiver shall be noted.

The transmitter shall be replaced by a substitution antenna as defined in sub-clause A.2.3.

The substitution antenna shall be orientated for vertical polarisation and the length of the substitution antenna shall be adjusted to correspond to the frequency of the spurious component detected.

The substitution antenna shall be connected to a calibrated signal generator.

The frequency of the calibrated signal generator shall be set to the frequency of the spurious component detected.

The input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver, if necessary.

The test antenna shall be raised and lowered through the specified range of heights to ensure that the maximum signal is received.

When a test site according to sub-clause A.3 is used there is no need to vary the height of the antenna.

The input signal to the substitution antenna shall be adjusted to the level that produced a level detected by the measuring receiver, that is equal to the level noted while the spurious

component was measured, corrected for the change of input attenuator setting of the measuring receiver.

The input level to the substitution antenna shall be recorded as power level.

The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarisation.

The measure of the effective radiated power of the spurious components is the larger of the two power levels recorded for each spurious component at the input to the substitution antenna, corrected for the gain of the antenna if necessary.

The measurement³ shall be repeated with the transmitter modulated by the normal test signal M2 (see sub-clause 6.1.3). if the measured power level of the conducted spurious emission increases by more than 6 dB when the transmitter is modulated. If possible, the modulation should be continuous for the duration of the measurement.

The measurement shall be repeated with the transmitter on stand-by.

7.4.4 Method of measuring the effective radiated power (sub-clause 7.4.1 (c))

This method applies only to equipment without an external 50Ω antenna connector.

The method of measurement shall be performed according to sub-clause 7.4.3, except that the transmitter output shall be connected to the integral antenna and not to an artificial antenna.

7.5 Intermodulation attenuation

This requirement applies only to transmitters to be used in base stations (fixed).

7.5.1 Definition

Intermodulation attenuation is the capability of a transmitter to avoid the generation of signals in the non-linear elements caused by the presence of the carrier and an interfering signal entering the transmitter via the antenna.

It is specified as the ratio, in dB, of the power level of the third order intermodulation product to the carrier power level.

³The bandwidth used in this measurement for each spurious emission shall be sufficiently wide to accept all significant components of the spurious emission concerned and sufficiently narrow to reject emissions in the five contiguous channels centred on the channel on which the transmitter is intended to operate. The conditions used in the relevant measurements shall be reported in the test report.

7.5.2 Method of measurement

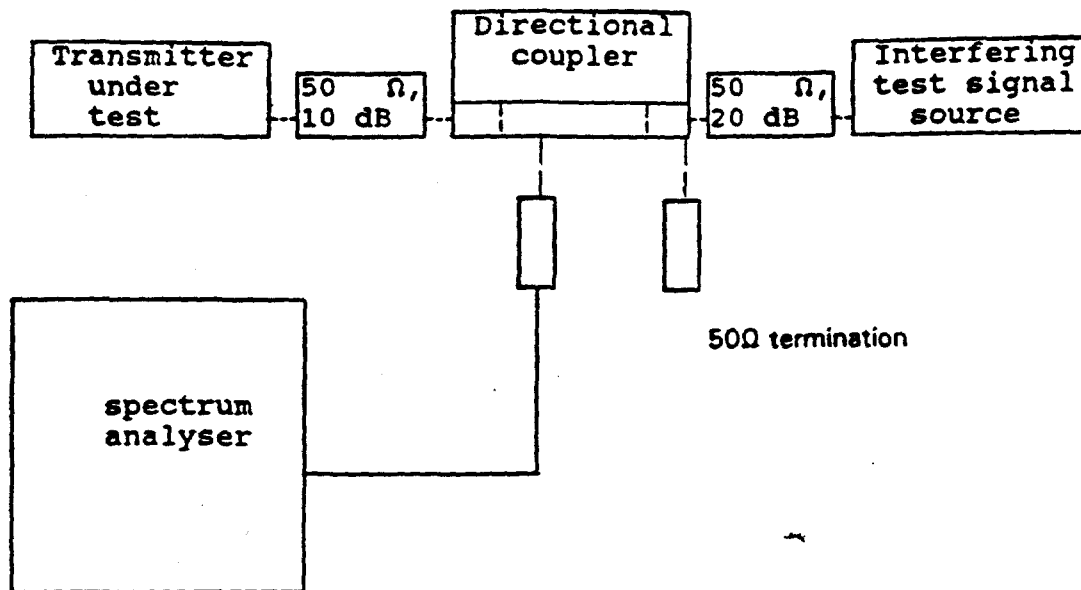


Figure 1: Measurement arrangement

The measurement arrangement shown in Figure 1 shall be used.

The transmitter shall be connected to a 50Ω, 10 dB attenuator and via a directional coupler to a spectrum analyser. An additional attenuator may be required between the directional coupler and the spectrum analyser to avoid overloading the spectrum analyser.

In order to reduce the influence of mismatch errors it is important that the 10 dB power attenuator is coupled to the transmitter under test with the shortest possible connection.

The interfering test signal source is connected to the other end of the directional coupler via a 50Ω, 20 dB attenuator.

The interfering signal source may be either a transmitter providing the same power output as the transmitter under test and be of a similar type or a signal generator and a power amplifier of equivalent intermodulation attenuation as that required from the transmitter, capable of delivering the same output power as the transmitter under test.

The directional coupler shall have an insertion loss of less than 1 dB, a sufficient bandwidth and a directivity of more than 20 dB.

The transmitter under test and the test signal source shall be physically separated in such a way that the measurement is not influenced by direct radiation.

Prior to the measurement, the PX of the transmitter under test shall be measured according to sub-clause 7.1.2 and the value recorded.

The transmitter under test shall be unmodulated and the spectrum analyser adjusted to give a maximum indication with a frequency scan width of 500 kHz.

The interfering test signal source shall be unmodulated and the frequency shall be within 50 kHz to 100 kHz above the frequency of the transmitter under test.

The frequency shall be chosen in such a way that the intermodulation components to be measured do not coincide with other spurious components. The power output of the interfering test signal source shall be adjusted to the PX level recorded above, by the use of a power meter.

The intermodulation components shall be measured by direct observation on the spectrum analyser of the ratio of the largest third order intermodulation component with respect to the PX.

This measurement shall be repeated with the interfering test signal source at a frequency within 50 kHz to 100 kHz below the frequency of the transmitter under test.

8. METHODS OF MEASUREMENT FOR RECEIVER PARAMETERS

8.1 Maximum usable sensitivity (analogue, conducted)

8.1.1 Definition

The maximum usable sensitivity (analogue) of the receiver is the minimum level of signal (e.m.f) at the receiver input, at the nominal frequency of the receiver and with the normal test signal (sub-clause 6.1.2), which will produce:

- an audio frequency output power of at least 50% of the rated power output (sub-clause 6.11) and
- a SINAD ratio of 20 dB, measured at the receiver output through a telephone psophometric weighting network as described in CCITT Recommendation 0.41 Red Book 1984.

8.1.2 Method of measuring the SINAD ratio

The normal test signal (sub-clause 6.1.2) shall be applied to the receiver input connector at the nominal frequency of the receiver.

An audio frequency output load, a SINAD meter incorporating a 1 kHz band-stop filter and a psophometric telephone weighting network as mentioned in sub-clause 8.1.1, shall be connected to the receiver output terminals.

Where possible, the receiver volume control shall be adjusted to give at least 50% of the rated output power (sub-clause 6.11) or, in the case of stepped volume controls, to the first step that provides an output power of at least 50% of the rated output power.

The test signal input level shall be reduced until a SINAD ratio of 20 dB is obtained.

The test signal input level under these conditions is the value of the maximum usable sensitivity.

The measurement shall be made under normal test conditions (sub-clause 5.3) and repeated under extreme test conditions (sub-clause 5.4.1 and 5.4.2 applied simultaneously).

Under extreme test conditions, the receiver audio output power shall be within ± 3.0 dB of the value obtained under normal test conditions.

8.2 Maximum usable sensitivity (analogue, field strength)

This method applies only to equipment without an external antenna connector.

8.2.1 Definition

The maximum usable sensitivity (analogue) of the receiver is the minimum field strength present at the location of the receiver, at the nominal frequency of the receiver and with normal test modulation (sub-clause 6.1.2), which will fulfil the requirements of sub-clause 8.1.1

8.2.2 Method of measurement

On a test site, selected from Annex A, the equipment shall be placed at the specified height on a non-conducting support and in the position closest to normal use as declared by the manufacturer.

The test antenna shall be orientated for vertical polarisation and the antenna shall be chosen to correspond to the frequency of the receiver.

The input of the test antenna shall be connected to a signal generator.

The signal generator shall be tuned to the frequency of the receiver under test and its output level shall be adjusted to 1 dB μ V.

The signal generator shall be modulated with normal test modulation according to sub-clause 6.1.2.

An audio frequency output load, a SINAD meter and a psophometric telephone weighting network as mentioned in sub-clause 8.1.1 shall be coupled to the receiver loudspeaker/transducer via an acoustic measuring arrangement described in sub-clause A.2.6.

Where possible, the receiver volume control shall be adjusted to give at least 50% of the rated output power (sub-clause 6.11) or in the case of stepped volume controls, to the first step that provides an output power of at least 50% of the rated power.

The test signal output level shall be increased until the acoustic SINAD ratio of 20 dB is obtained.

The test antenna shall be raised and lowered through the specified range of height to find the lowest level of the test signal that produces an acoustic SINAD ratio of 20 dB.

When a test site according to sub-clause A.3 is used there is no need to vary the height of the antenna.

The receiver shall then be rotated through 360° in the horizontal plane to find the lowest level of the test signal that produces an acoustic SINAD ratio of 20 dB.

The input signal level to the test antenna shall be maintained.

The receiver shall be replaced by a substitution antenna as defined in sub-clause A.2.3.

The substitution antenna shall be orientated for vertical polarisation and the length of the substitution antenna shall be adjusted to correspond to the frequency of the receiver.

The substitution antenna shall be connected to a calibrated measuring receiver.

The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.

When a test site according to sub-clause A.3 is used there is no need to vary the height of the antenna.

The signal level measured with the calibrated measuring receiver shall be recorded as the field strength in dB μ V/m.

The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarisation.

The measure of the maximum usable sensitivity expressed as field strength is the minimum of the two signal levels recorded as the input to the calibrated measuring receiver, corrected for the gain of the antenna if necessary.

8.3 Maximum usable sensitivity (data, conducted)

8.3.1 Definition

The maximum usable sensitivity (data) of the receiver is the minimum level of signal (e.m.f.) at the receiver input, at the nominal frequency of the receiver, with normal test signal M2 (sub-clause 6.1.3), which without interference will produce after demodulation a data signal with a specified bit error ratio (see sub-clause 4.2.1.3) or a specified successful message ratio.

The specified bit error ratio is 10^{-2} . The specified successful message ratio is 0.9.

- e. The maximum usable sensitivity is the higher of the two values recorded in steps c and d, above.
- f. The measurement shall be made under normal test conditions (sub-clause 5.3) and repeated under extreme test conditions (sub-clauses 5.4.1 and 5.4.2 applied simultaneously).

8.3.3 Method of measurement with messages

In the case where operation using a continuous bit stream is not possible, the following method of measurement shall be applied.

- a. A signal with a centre frequency equal to the nominal centre frequency of the receiver and modulated with the normal test signal (sub-clause 6.4) in accordance with instructions of the manufacturer (and approved by the Radiocommunications Agency) shall be applied to the receiver input terminals.
- b. The level of this signal shall be such that a successful message rate of less than 10% is obtained.
- c. The normal test signal shall be transmitted repeatedly whilst observing in each case whether or not a successful response is obtained. The input level shall be increased by 2 dB for each occasion that a successful response is not obtained. The procedure shall be continued until three consecutive successive responses are observed. The level of the input signal shall be recorded.
- d. The input signal level shall be reduced by 1 dB and the new value recorded. The normal test signal shall then be transmitted 20 times. In each case, if a response is not obtained the input level shall be increased by 1 dB and the new value recorded. If a successful response is obtained, the input shall not be changed until three consecutive successful responses have been obtained. In this case, the input level shall be reduced by 1 dB and the new value recorded.

NOTE: No input levels shall be recorded unless preceded by a change in level.

- e. The maximum usable sensitivity is the average of the values recorded in steps c and d.
- f. The measurement shall be made under normal test conditions (sub-clause 5.3) and repeated under extreme test conditions (sub-clauses 5.4.1 and 5.4.2 applied simultaneously).

8.4 Maximum usable sensitivity (data, field strength)

This measurement applies only for equipment without an external antenna connection.

8.4.1 Definition

The maximum usable sensitivity of the receiver is the minimum field strength present at the location of the receiver created by a signal, at the nominal frequency of the receiver, with the normal test signal (sub-clause 6.1.3) which will allow the receiver to fulfil the requirements of sub-clause 8.3.

8.4.2 Method of measurement with continuous bit streams

The manufacturer shall specify the polarisation of the RF field for which the equipment has been designed.

Arrangements shall be made by the manufacturer to couple the unit under test to the bit error rate measuring device by a method which does not affect the radiated field (see also sub-clause 6.12.2).

8.4.2.1 Test conditions

Three test conditions are specified:

- a. The manufacturer declares the direction corresponding to the maximum usable sensitivity. In this case this position is used to perform the measurement in sub-clause 8.4.2.2
- b. If the manufacturer does not declare the position corresponding to the maximum usable sensitivity but provides an analogue output according to sub-clause 6.12.1, then this output will be used to determine the direction of maximum usable sensitivity. This will be the position used for the measurement in sub-clause 8.4.2.2.
- c. If the direction corresponding to the maximum usable sensitivity cannot be determined as specified in a or b above, then an initial position will be used and the measurement in sub-clause 8.4.2.2 will be repeated with eight positions, 45° apart. The maximum usable sensitivity will be determined from the minimum field strength recorded.

8.4.2.2 Test procedure

On a test site, selected from Annex A, the equipment shall be placed at the specified height on a non-conducting support, in the position determined in sub-clause 8.4.2.1. The position shall be recorded in the test report.

The test antenna shall be orientated for the polarisation specified by the manufacturer and the length of the test antenna shall be chosen to correspond to the frequency of the receiver. The input of the test antenna shall be connected to a signal generator.

The signal generator shall be tuned to the frequency of the receiver under test and its output level shall be adjusted to 100 dB μ V.

The signal generator shall be modulated by the normal test signal M2 (sub-clause 6.1.3).

The raw bit stream produced by the receiver will be monitored.

The test signal output level shall be reduced in 1 dB steps until a bit error ratio of higher than 10^{-2} is obtained. The test signal shall then be increased by 1 dB.

The test antenna shall be raised and lowered through the specified range of height to find the lowest level of the test signal that still produces a bit error ratio of 10^{-2} or lower. The test antenna need not be raised or lowered if the measurement is carried out according to sub-clause A.3.

The input signal level to the test antenna shall be noted and maintained.

The receiver shall then be replaced by a substitution antenna as defined in sub-clause A.2.3.

The substitution antenna shall be orientated for the polarisation of the test antenna and the length of the substitution antenna shall be adjusted to correspond to the frequency of the receiver.

The substitution antenna shall be connected to a calibrated measuring receiver.

The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.

The test antenna need not be raised or lowered if the measurement is carried out on a test site according to sub-clause A.3.

The measured signal level shall be recorded as field strength in dB μ V/m, this is the maximum usable sensitivity, corresponding to the direction used.

8.4.3 Method of measurement with messages

In the case where operation using a continuous bit stream is not possible, the following method of measurement shall be applied.

The manufacturer shall specify the polarisation of the RF field for which the equipment has been designed.

Arrangements shall be made by the manufacturer to couple to the unit under test the observation device by a method which does not affect the radiated field (see also sub-clause 6.12.3.2).

8.4.3.1 Test conditions

Three test conditions are specified:

- a. The manufacturer declares the direction corresponding to the maximum usable sensitivity. In this case this position is used to perform the measurement in sub-clause 8.4.3.2
- b. If the manufacturer does not declare the position corresponding to the maximum usable sensitivity but provides an analogue output according to sub-clause 6.12.1, then this output will be used to determine the direction of maximum usable sensitivity. This will be the position used for the measurement in sub-clause 8.4.3.2.
- c. If the direction corresponding to the maximum usable sensitivity cannot be determined as specified in a or b above, then an initial position will be used and the measurement in sub-clause 8.4.3.2 will be repeated with eight positions, 45° apart. The maximum usable sensitivity will be determined from the minimum field strength recorded.

8.4.3.2 Test procedure

On a test site, selected from Annex A, the equipment shall be placed at the specified height on a non-conducting support, in the position determined in sub-clause 8.4.3.1. The position shall be recorded in the test report.

The test antenna shall be orientated for the polarisation specified by the manufacturer and the length of the test antenna shall be chosen to correspond to the frequency of the receiver.

The input of the test antenna shall be connected to a signal generator.

The signal generator shall be tuned to the frequency of the receiver under test and its output level shall be adjusted to 100 dB μ V.

The signal generator shall be modulated by the normal test signal in accordance with sub-clause 8.3.3.a.

The test antenna shall be raised and lowered through the specified range of height to find the lowest level of the test signal necessary.

The test antenna need not be raised or lowered if the measurement is carried out on a test site according to sub-clause A.3.

Under these test conditions and positions, the actual sensitivity will be measured using the method described in sub-clause 8.3.3 b to d, using the test antenna and the signal generator connected to it.

The input signal level to the test antenna shall be set to the average of the values noted (see sub-clause 8.3.3.e).

The receiver shall then be replaced by a substitution antenna as defined in sub-clause A.2.3.

The substitution antenna shall be orientated for the polarisation specified and the length of the substitution antenna shall be adjusted to correspond to the frequency of the receiver.

The substitution antenna shall be connected to a calibrated measuring receiver.

The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.

The test antenna need not be raised or lowered if the measurement is carried out on a test site according to sub-clause A.3.

The measured signal level shall be recorded as field strength in dB μ V/m, this is the maximum usable sensitivity, corresponding to the direction used.

8.5 Near channel selectivity

8.5.1 Definition

The near channel selectivity is the capability of the receiver to receive a wanted modulated signal at the nominal frequency without exceeding a given degradation due to the presence of an unwanted signal which differs from the channel centre of the wanted signal by between 3 kHz and 10 kHz.

8.5.2 Method of measurement

8.5.2.1 Method of measurement (analogue)

The two input signals shall be connected to the receiver via a combining network (see also sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, with normal test modulation (sub-clause 6.1.3), at an e.m.f of 6 dB μ V (value of the limit for the maximum usable sensitivity) shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal M3 (sub-clause 6.1.3), at 5 kHz above the nominal frequency of the receiver, shall be applied to the receiver input connector via the second input of the combining network.

The amplitude of the unwanted test signal shall be adjusted until the SINAD ratio, psophometrically weighted, at the output of the receiver is reduced to 14 dB.

The measure of the selectivity is the ratio in dB of the level of the unwanted test signal to the level of the wanted test signal at the receiver input for which the specified reduction in SINAD ratio occurs.

This ratio shall be noted.

The measurement shall be repeated with an unwanted signal at 5 kHz below the nominal frequency of the receiver.

The two noted ratios shall be recorded as the upper and lower 5 kHz selectivity.

The measurements shall be repeated with an unwanted signal at 10 kHz above the nominal frequency of the receiver and with an unwanted signal at 10 kHz below the nominal frequency of the receiver. The two noted ratios shall be recorded as the upper and lower 10 kHz selectivity.

The measurements shall be repeated with an unmodulated unwanted signal at 3 kHz above the nominal frequency of the receiver and with an unmodulated unwanted signal at 3 kHz below the nominal frequency of the receiver. The two noted ratios shall be recorded as the upper and lower 3 kHz selectivity.

The measurements shall be made under normal test conditions (sub-clause 5.3) and shall be repeated under extreme test conditions (sub-clauses 5.4.1 and 5.4.2 applied simultaneously), with the amplitude of the wanted test signal adjusted to an e.m.f of 12 dB μ V.

8.5.2.2 Method of measurement (data with continuous bit stream)

The two input signals shall be connected to the receiver via a combining network (see also sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, modulated by normal test signal M2 (sub-clause 6.1.3), at an e.m.f of 6 dB μ V shall be applied to the receiver input

The unwanted test signal M3 (sub-clause 6.1.3), at 5 kHz above the nominal frequency of the receiver, shall be applied to the receiver input connector via the second input of the combining network.

The input level of the unwanted test signal shall be adjusted until a bit error ratio of 10^{-1} is obtained.

The normal test signal M2 shall be transmitted whilst observing the bit error ratio. The level of the unwanted signal shall be reduced in steps of 1 dB until a bit error ratio of 10^{-2} or better is obtained. The level of the unwanted signal shall then be recorded.

The selectivity shall be expressed as the ratio in dB of the levels of the unwanted signal to the level of the wanted signal, at the receiver input.

This ratio shall be noted.

The measurement shall be repeated with the unwanted signal at 5 kHz below the nominal frequency of the receiver.

The two noted ratios shall be recorded as the upper and lower 5 kHz selectivity.

The measurements shall be repeated with an unwanted signal at 10 kHz above the nominal frequency of the receiver and with an unwanted signal at 10 kHz below the nominal frequency of the receiver. The two noted ratios shall be recorded as the upper and lower 10 kHz selectivity.

The measurements shall be repeated with an unmodulated unwanted signal at 3 kHz above the nominal frequency of the receiver and with an unmodulated unwanted signal at 3 kHz below the nominal frequency of the receiver. The two noted ratios shall be recorded as the upper and lower 3 kHz selectivity.

The measurements shall be made under normal test conditions (sub-clause 5.3) and shall be repeated under extreme test conditions (sub-clauses 5.4.1 and 5.4.2 applied simultaneously), with the amplitude of the wanted test signal adjusted to an e.m.f of 12 dB μ V, unless analogue selectivity measurements were made, in which case the selectivity (data) has to be measured only under normal test conditions.

8.5.2.3 Method of measurement (data with messages)

In the case where operation using a continuous bit stream is not possible, the following method of measurement shall be applied.

The two input signals shall be connected to the receiver via a combining network (see also sub-clause 7.0).

The wanted test signal, at the nominal frequency of the receiver, modulated by the normal test signal (sub-clause 6.1.3), at an e.m.f of 6 dB μ V shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal M3 (sub-clause 6.1.3), at 5 kHz above the nominal frequency of the receiver, shall be applied to the receiver input connector via the second input of the combining network.

The input level of the unwanted test signal shall be adjusted until a successful message rate of less than 10% is obtained. The following procedure shall then be applied.

- a The normal test signal shall be transmitted repeatedly whilst observing in each case whether or not a successful response is obtained. The level of the unwanted signal shall be reduced by 2 dB for each occasion that a successful response is not obtained. The procedure shall be continued until three consecutive successful responses are observed. The level of the input signal shall then be recorded.
- b The unwanted input signal level shall be increased by 1 dB and the new value recorded. The normal test signal shall then be transmitted 20 times. In each case, if a response is not obtained the level of the unwanted signal shall be reduced by 1 dB and the new value recorded. If a successful response is obtained, the level of the unwanted signal shall not be changed until three consecutive successful responses have been obtained. In this case the unwanted signal shall be increased by 1 dB and the new value recorded.

NOTE: No levels of the unwanted signal shall be recorded unless preceded by a change in level.

The average of the levels of the unwanted signal recorded in steps a and b shall be calculated and the ratio of this value to the level of the wanted input signal is the selectivity.

This ratio shall be noted.

The measurement shall be repeated with the unwanted signal at 5 kHz below the nominal frequency of the receiver.

The two noted ratios shall be recorded as the upper and lower 5 kHz selectivity.

The measurements shall be repeated with an unwanted signal at 10 kHz above the nominal frequency of the receiver and with an unwanted signal at 10 kHz below the nominal frequency of the receiver. The two noted ratios shall be recorded as the upper and lower 10 kHz selectivity.

The measurements shall be repeated with an unmodulated unwanted signal at 3 kHz above the nominal frequency of the receiver and with an unmodulated unwanted signal at 3 kHz below

8.6 Spurious response rejection

8.6.1 Definition

The spurious response rejection is a measure of the capability of the receiver to discriminate between the wanted modulated signal at the nominal frequency and an unwanted signal at any other frequency at which a response is obtained.

8.6.2 Method of measurement

8.6.2.1 Introduction to the method of measurement

To determine the frequencies at which spurious responses can occur the following calculations shall be made:

a. calculation of the "limited frequency range".

The "limited frequency range" is equal to:

the frequency of the local oscillator signal (f_{lo}) applied to the first mixer of the receiver \pm the sum of the intermediate frequencies (if_1, \dots, if_n) and half the switching range (sr) of the receiver (see clause 3).

Hence:

$$\text{the "limited frequency range"} = f_{lo} \pm (if_1 + if_2 + \dots + if_n + \frac{sr}{2})$$

b. calculation of frequencies outside the "limited frequency range".

The calculation of the frequencies at which spurious responses can occur outside the range determined in a is made for the remainder of the frequency range of interest, as given in sub-clauses 8.6.2.3, 8.6.2.4 and 8.6.2.5.

The frequencies outside the "limited frequency range" are equal to:

the harmonics of the local oscillator signal (f_{lo}) applied to the first mixer of the receiver or the harmonics of any other oscillator used to generate reference frequencies in the receiver (f_r) present at the first mixer of the receiver \pm the numeric value of the first intermediate frequency (if_1) of the receiver.

Hence the frequencies of these spurious responses

$$= nf_{lo} \pm if_1 \text{ and } pf_r \pm if_1$$

where n is an integer greater than or equal to 2

where p is an integer greater than or equal to 1.

The measure of the first image response of the receiver shall initially be made to verify the calculation of spurious response frequencies.

For the calculations a and b above the manufacturer shall state the frequency of the receiver, the frequency of the local oscillator signal (f_{lo}) applied to the first mixer of the receiver, the intermediate frequencies (if_1 , if_2 etc.) and the switching range (sr) of the receiver.

8.6.2.2 Method of search over the "limited frequency range"

The two input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal at the nominal frequency of the receiver, with normal test modulation (sub-clause 6.1.3), at an e.m.f. of 6 dB μ V shall be applied to the receiver input connector via one input of the combining network.

The unwanted signal, the test signal M3 (sub-clause 6.1.3), at an e.m.f. of 86 dB μ V, shall be applied to the receiver input connector via the second input of the combining network.

The frequency of the unwanted signal shall be varied incrementally over the "limited frequency range".

The incremental steps of the frequency of the unwanted signal shall be 5 kHz.

The frequency of any spurious response detected during the search shall be recorded for use in measurements in accordance with sub-clauses 8.6.2.3, 8.6.2.4 and 8.6.2.5.

8.6.2.3 Method of measurement (analogue)

The two input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, with normal test modulation (sub-clause 6.1.3), at an e.m.f. of 6 dB μ V, value of the limit for the maximum usable sensitivity, shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal M3 (sub-clause 6.1.3), at an e.m.f. of 86 dB μ V, shall be applied to the receiver input connector via the second input of the combining network.

The measurement shall then be performed at all spurious response frequencies found during the search over the "limited frequency range" (sub-clause 8.6.2.2), and at the frequencies calculated for the remainder of the spurious response frequencies (sub-clause 8.6.2.1) in the frequency range 100 kHz to 2 GHz for equipment operating on frequencies not exceeding 470 MHz or in the frequency range 100 kHz to 4 GHz for equipment operating above 470 MHz.

At each frequency at which a spurious response occurs, the input level of the unwanted signal shall be adjusted until the SINAD ratio, psophometrically weighted, is reduced to 14 dB.

The measure of the spurious response rejection is the ratio in dB of the level of the unwanted test signal to the level of the wanted test signal at the receiver input for which the specified reduction in SINAD ratio occurs.

The ratio shall be recorded as the spurious response rejection for each spurious response obtained.

8.6.2.4 Method of measurement (data with continuous bit streams)

The two input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, modulated by normal test signal M2 (sub-clause 6.1.3), at an e.m.f. of 6 dB μ V, shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal M3 (sub-clause 6.1.3), at an e.m.f. of 86 dB μ V, shall be applied to the receiver input connector via the second input of the combining network.

The measurement shall then be performed at all spurious response frequencies found during the search over the "limited frequency range" (sub-clause 8.6.2.2) and at the frequencies calculated for the remainder of the spurious response frequencies (sub-clause 8.6.2.1) in the frequency range 100 kHz to 2 GHz for equipment operating on frequencies not exceeding 470 MHz or in the frequency range 100 kHz to 4 GHz for equipment operating above 470 MHz.

At each frequency at which a spurious response occurs, the normal test signal M2 shall be transmitted whilst observing the bit error ratio. The level of the unwanted signal shall be adjusted in steps of 1 dB until a bit error ratio of 10^{-2} or better is obtained. The level of the unwanted signal shall then be recorded.

The measure of the spurious response rejection is the ratio in dB of the level of the unwanted test signal to the level of the wanted test signal at the receiver input for which the specified bit error ratio occurs.

The ratio shall be recorded as the spurious response rejection for each spurious response obtained.

8.6.2.5 Method of measurement (data with messages)

In the case where operation using a continuous bit stream is not possible, the following method of measurement shall be applied.

The two input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, modulated by the normal test signal (see sub-clause 6.1.3), at an e.m.f. of 6 dB μ V, shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal M3 (sub-clause 6.1.3), at an e.m.f. of 86 dB μ V, shall be applied to the receiver input connector via the second input of the combining network.

The measurement shall then be performed at all spurious response frequencies found during the search over the "limited frequency range" (sub-clause 8.6.2.2), and at the frequencies calculated for the remainder of the spurious response frequencies (sub-clause 8.6.2.1) in the frequency range 100 kHz to 2 GHz for equipment operating on frequencies not exceeding 470 MHz or in the frequency range 100 kHz to 4 GHz for equipment operating above 470 MHz.

At each frequency at which a spurious response occurs, the input level of the unwanted test signal shall be adjusted until a successful message rate of less than 10% is obtained. The

The unwanted test signal (C) M3 (sub-clause 6.1.3), at the frequency 50 kHz above the nominal frequency of the receiver, shall be applied to the receiver input connector via the third input of the combining network.

The amplitude of the unwanted test signals (B) and (C) shall be maintained equal and adjusted until the SINAD ratio, psophometrically weighted, at the output of the receiver is reduced to 14 dB.

The measure of the intermodulation response rejection is the ratio in dB of the level of the unwanted test signals to the level of the wanted test signal at the receiver input for which the specified reduction in SINAD ratio occurs.

This ratio shall be recorded.

The measurement shall be repeated with the unwanted signal (B) at the frequency 50 kHz above the wanted signal and with the unwanted signal (C) at the frequency 100 kHz above the wanted signal.

The two sets of measurements described above shall be repeated with the unwanted signals below the nominal frequency of the receiver by the specified amounts.

8.7.2.2 Method of measurement (data with continuous bit stream)

Three input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal (A), at the nominal frequency of the receiver, with normal test modulation, at an e.m.f of 6 dB μ V shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal (B), at the frequency 25 kHz above the nominal frequency of the receiver, without modulation, shall be applied to the receiver input connector via the second input of the combining network.

The unwanted test signal (C) M3 (sub-clause 6.1.3), at the frequency 50 kHz above the nominal frequency of the receiver, shall be applied to the receiver input connector via the third input of the combining network.

The output levels of the two signals shall be kept equal and adjusted to a value such that a bit error ratio of about 10^{-1} is obtained.

The normal test signal M2 shall be transmitted whilst observing the bit error ratio. The level of the unwanted signal shall be reduced in steps of 1 dB until a bit error ratio of 10^{-2} or better is obtained. The level of the input signals shall then be recorded.

The measure of the intermodulation response rejection is the ratio in dB of the input levels of the two unwanted signals (B&C) to the level of the wanted signal (A).

This ratio shall be recorded.

The measurement shall be repeated with the unwanted signal (B) at the frequency 50 kHz above the wanted signal and with the unwanted signal (C) at the frequency 100 kHz above the wanted signal.

The two sets of measurements described above shall be repeated with the unwanted signals below the nominal frequency of the receiver by the specified amounts.

8.7.2.3 Method of measurement (data with messages)

The two sets of measurements described above shall be repeated with the unwanted signals below the nominal frequency of the receiver by the specified amounts.

8.8 Blocking or desensitisation

8.8.1 Definition

Blocking is a change (generally a reduction) in the wanted output of a receiver or a reduction of the SINAD ratio, or an increase in the BER, due to an unwanted signal on another frequency.

8.8.2 Method of measurement

8.8.2.1 Method of measurement (analogue)

The two input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, with normal test modulation (sub-clause 6.1.3), at an e.m.f. of 6 dB μ V, value of the limit for the maximum usable sensitivity, shall be applied to the receiver input connector via one input of the combining network.

Where possible the receiver volume control shall be adjusted to give at least 50% of the rated output power (sub-clause 6.11) or, in the case of stepped volume controls, to the first step that provides an output power of at least 50% of the rated output power.

The obtained audio output level shall be noted.

The unwanted test signal, at a frequency from 1 MHz to 10 MHz offset from the nominal frequency of the receiver, without modulation, shall be applied to the receiver input connector via the second input of the combining network.

For practical reasons the measurements shall be carried out at frequencies of the unwanted signal at approximately ± 1 MHz, ± 2 MHz, ± 5 MHz and ± 10 MHz.

The amplitude of the unwanted test signal shall be adjusted until:

- a reduction of 3 dB in the audio output level of the wanted signal; or
- the SINAD ratio, psophometrically weighted, at the output of the receiver is reduced to 14 dB,

whichever occurs first.

This level shall be noted.

The measure of the blocking or desensitisation is the ratio in dB of the level of the unwanted test signal to the level of the wanted test signal at the receiver input for which the specified reduction in audio output level or in the SINAD ratio occurs.

This ratio shall be recorded for each of the eight levels as the blocking or desensitisation.

8.8.2.2 Method of measurement (data with continuous bit stream)

The two input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, with normal test modulation (sub-clause 6.1.3), at an e.m.f. of 6 dB μ V shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal, at a frequency from 1 MHz to 10 MHz offset from the nominal frequency of the receiver, without modulation, shall be applied to the receiver input connector via the second input of the combining network.

For practical reasons the measurements shall be carried out at frequencies of the unwanted signal at approximately ± 1 MHz, ± 2 MHz, ± 5 MHz and ± 10 MHz.

The level of the unwanted signal shall be adjusted until a bit error ratio of less than 10^{-1} is obtained.

The following procedure shall then be applied.

The normal test signal shall then be transmitted whilst observing the bit error ratio. The level of the unwanted signal shall be reduced in steps of 1 dB until a bit error ratio of 10^{-2} or better is obtained. The level of the unwanted signal shall then be recorded.

The measure of the blocking or desensitisation is the ratio in dB of the level of the unwanted test signal to the level of the wanted test signal at the receiver input for which the specified bit error ratio occurs.

This ratio shall be recorded for each of the eight levels as the blocking or desensitisation.

8.8.2.3 Method of measurement with messages

In the case where operation using a continuous bit stream is not possible, the following method of measurement shall be applied.

The two input signals shall be connected to the receiver via a combining network (sub-clause 6.9).

The wanted test signal, at the nominal frequency of the receiver, with normal test modulation (see sub-clause 6.1.3), at an e.m.f. of 6 dB μ V shall be applied to the receiver input connector via one input of the combining network.

The unwanted test signal, at a frequency from 1 MHz to 10 MHz offset from the nominal frequency of the receiver, without modulation, shall be applied to the receiver input connector via the second input of the combining network.

For practical reasons the measurements shall be carried out at frequencies of the unwanted signal at approximately ± 1 MHz, ± 2 MHz, ± 5 MHz and ± 10 MHz.

The level of the unwanted signal shall be adjusted until a successful message rate of less than 10% is obtained.

The following procedure shall then be applied.

- a The normal test signal shall be transmitted repeatedly whilst observing in each case whether or not a successful response is obtained. The levels of the unwanted signals shall be reduced by 2 dB for each occasion that a successful response is not obtained. The procedure shall be continued until three consecutive successful responses are observed. The level of the input signals shall then be recorded.
- b The unwanted input signal level shall be increased by 1 dB and the new value recorded. The normal test signal shall then be transmitted 20 times. In each case, if a response is not obtained the level of the unwanted signals shall be reduced by 1 dB and the new value recorded. If a successful response is obtained, the level of the unwanted signals shall not be changed until three consecutive successful responses have been obtained. In this case the unwanted signals shall be increased by 1 dB and the new value recorded.

NOTE: No levels of the unwanted signals shall be recorded unless preceded by a change in level.

The measure of the blocking or desensitisation is the ratio in dB of the average of the levels of the unwanted signal recorded in steps a and b to the level of the wanted test signal at the receiver input.

This ratio shall be recorded for each of the eight levels as the blocking or desensitisation.

8.9 Spurious radiations

8.9.1 Definition

Spurious radiations from the receiver are components at any frequency, radiated by the equipment and antenna.

The level of spurious radiations shall be measured by

either

- a) their power level in a specified load (conducted spurious emission)

and

- b) their effective radiated power when radiated by the cabinet and structure of the equipment (cabinet radiation),

or

- c) their effective radiated power when radiated by the cabinet and the integral antenna, in the case of handportable equipment fitted with such an antenna and no external RF connector.